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AFRL-SR-AR-TR-04-

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tion

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE

3. REPORT TYPE AND DATES COVERED

15 Jul 2002 - 31 May 2003 FINAL

4. TITLE AND SUBTITLE

A WORKSHOP ON VACUUM ELECTRONICS RESEARCH FOR THE DoD

5. FUNDING NUMBERS

2301/EX

61102F

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

UNIVERSITY OF CALIFORNIA

SPONSORED PROGRAM 118

EVERSON HALL

DAVIS CA 95616

8. PERFORMING ORGANIZATION  
REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

AFOSR/NE

4015 WILSON BLVD

SUITE 713

ARLINGTON VA 22203

10. SPONSORING/MONITORING  
AGENCY REPORT NUMBER

F49620-02-1-0377

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The University of California, Davis hosted the workshop and publication working group from July 27-30, 2002 at the Royal Kona Resort in Kailua-Kona, Hawaii and a March 11-13, 2003, Las Vegas, Nevada, Treasure Island. The purpose was to bring together researchers from Academia, the Air Force Research Laboratory (Phillips Site), other government scientific organizations as well as from industry, to discuss the role of Innovative Vacuum Electronics in the frontiers of microwave/millimeter wave power electronics.

20040213 106

14. SUBJECT TERMS

Innovative Vacuum Electronics and microwave/millimeter wave power electronics

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION  
OF REPORT

UNCLASSIFIED

18. SECURITY CLASSIFICATION  
OF THIS PAGE

UNCLASSIFIED

19. SECURITY CLASSIFICATION  
OF ABSTRACT

UNCLASSIFIED

20. LIMITATION OF ABSTRACT

UL

Standard Form 298 (Rev. 2-89) (EG)  
Prescribed by ANSI Std. Z39.18  
Designed using Perform Pro, WHS/DIOR, Oct 94

**DOD FINAL REPORT**  
**U.S. Department of Defense Grant No. F49620-02-1-0377**

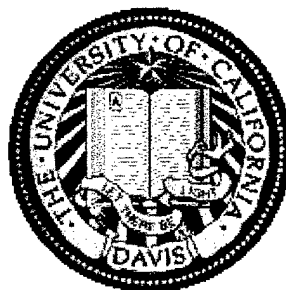


July 2003

**A Workshop on Vacuum Electronics Research for the DoD**

**PRINCIPAL INVESTIGATOR:**  
**Prof. N.C. Luhmann, Jr.**

Phone: (530) 752-5414  
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**UNIVERSITY OF CALIFORNIA, DAVIS**  
Department of Applied Science and  
Department of Electrical and Computer Engineering

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The meeting agenda for Hawaii was as follows:

**Saturday, 27, July 2002:**      Overview of Book Project (Bob Barker + participants)

- Motivation & Title
- Tentative Timetable
- Roles of Editors, Chapter Masters (CMs), & Contributing Authors
- Publisher(s) and Proposal Process
- Air Force Cooperative Agreement
- Royalties
- The Book Website - Assembling the book on-line
- Artistic License for CMs and authors
- IEEE Rules for Authors
- Standards for units
- Standards for graphics

1:30 - 2:00 pm - Foreword, Preface, List of Acronyms, and INDEX (Bob Barker)

2:00 - 3:00 pm - Subject outline & perspective authors for Chapter 1 (John Booske)  
"Introduction and Overview"

3:00 - 4:00 pm - Subject outline & perspective authors for Chapter 2 (Neville Luhmann)  
"Historical Highlights, Applications, and Trends"

4:00 - 4:30 pm - Wrap-up for DAY 1 (Neville Luhmann + participants)

**Sunday, 28 July 2002**

9:00 - 9:30 am - Additional thoughts about Day 1 topics (Bob Barker + participants)

9:30 - 10:30 am - Subject outline & perspective authors for Chapter 3 (John Booske)  
"TWTs"

10:30 - 11:30 am - Subject outline & perspective authors for Chapter 4 (George Caryotakis)  
"Klystrons"

1:00 - 2:00 pm - Subject outline & perspective authors for Chapter 5 (Gregory Nusinovich for Bruce Danly) "Gyro-Amplifiers"

2:00 - 3:00 pm - Subject outline & perspective authors for Chapter 12 (Dave Abe)  
"Innovations in MVED Materials"

3:00 - 3:30 pm - Break

3:30 - 4:30 pm - Subject outline & perspective authors for Chapter 7 (Glenn Scheitrum)  
"Microfabricated MVEDs"

4:30 - 5:30 pm - Subject outline & perspective authors for Chapter 8 (Jon Heritage)  
"Advanced Cathodes"

5:30 - 6:00 pm - Wrap-up for Day 2 (Neville Luhmann + participants)

### **Monday, 29 July 2002**

9:00 - 9:30 am - Additional thoughts about topics from Days 1 & 2 (Neville Luhmann)

9:30 - 10:30 am - Subject outline & perspective authors for Chapter 9 (John Booske for  
Ken Kreischer) "Understanding Linearity"

10:30 - 11:30 am - Subject outline & perspective authors for Chapter 10 (Lars Ludeking)  
"Computational Modeling"

11:30 - 1:00 pm - Lunch Break

1:00 - 2:00 pm - Subject outline & perspective authors for Chapter 11 (Rick Temkin)  
"Next-Generation Microwave Structures & Circuits"

2:00 - 3:00 pm - Subject outline & perspective authors for Chapter 6 (Ron Gilgenbach)  
"Crossed-Field Devices"

3:00 - 3:30 pm - Break

3:30 - 4:30 pm - Subject outline & perspective authors for Chapter 13 (Neville Luhmann for  
Carter Armstrong) "MVE/Solid-State Hybrids"

4:30 - 5:30 pm - Subject outline & perspective authors for Chapter 14 (Don Shiffler)  
"HPM Sources"

5:30 - 6:00 pm - Wrap-up for Day 3 (John Booske + participants)

### **Tuesday, 30 July 2002**

9:00 - 10:00 am - Thoughts on "Future" for Chapter 15 (Vic Granatstein)  
"Emerging Applications and Future Possibilities"

10:00 - 11:00 am - Flow of chapters - possible restructure (Neville Luhmann + participants)

11:00 - 12:00 pm - Allocation of tasks and timing for completing proposal & first draft  
(Bob Barker + participants)

12:00 pm - ALOHA!

NOTE: Remaining editors and chapter masters are invited to continue to meet informally over the following days before the US-Japan Symposium starts on Sunday to finalize follow-up actions and to begin fleshing out the actual book.

The attendees were:

Dr. David K. Abe  
National Research Laboratory

Prof. Thomas M. Antonsen, Jr.  
IREAP

Dr. Robert J. Barker  
AFOSR (NE)

Prof. John H. Booske  
University of Wisconsin

Dr. George Caryotakis  
Stanford Linear Accelerator Center

Prof. Ronald M. Gilgenbach  
University of Michigan

Prof. Victor L. Granatstein  
University of Maryland

Dr. Patrick Helles  
AFRL/VSSE

Prof. Jonathan P. Heritage  
University of California, Davis

Prof. Peter A. Lindsay

Queen Mary, University of London

Dr. Kendrick X. Liu  
University of California, Davis

Dr. Larry D. Ludeking  
Mission Research Corporation

Prof. Neville C. Luhmann, Jr.  
University of California, Davis

Dr. Gregory Nusinovich  
IREAP

Dr. John C. Rodgers  
IREAP

Dr. John Scharer  
University of Wisconsin

Dr. Glenn P. Scheitrum  
Stanford Linear Accelerator Center

Dr. Donald Shiffler  
Air Force Research Laboratory

Dr. Richard J. Temkin  
Massachusetts Institute of Technology

The meeting agenda for the Las Vegas Workshop was as follows:

***Tuesday, March 11<sup>th</sup>***

|                |                                   |
|----------------|-----------------------------------|
| 9:00-9:30 AM   | Overview of Book Project (Barker) |
| 9:30-10:00 AM  | Chap 1 (Booske)                   |
| 10:00-10:30 AM | Chap 2 (Luhmann)                  |
| 10:30-11:00 AM | Chap 4 (Booske)                   |
| 11:00-11:30 AM | Chap 5 (Nusinovich for Danly)     |
| 11:30-12:00 PM | Chap 6 (Gilgenbach)               |

Room available till 6PM for working groups

***Wednesday, March 12<sup>th</sup>***

|                |                               |
|----------------|-------------------------------|
| 9:00-9:30 AM   | Chap 3 (Caryotakis)           |
| 9:30-10:00 AM  | Chap 7 (Scheitrum)            |
| 10:00-10:30 AM | Chap 8 (Umstattd)             |
| 10:30-11:00 AM | Chap 9 (Booske for Kreischer) |
| 11:00-11:30 AM | Chap 10 (Ludeking)            |
| 11:30-12:00 PM | Chap 14 (Vanzant)             |

Room available until 6PM

***Thursday, March 13<sup>th</sup>***

|                |   |
|----------------|---|
| 8:00-9:30 AM   | Chap 11 (Temkin)                        |
| 9:30-10:00 AM  | Chap 13 (Barker)                        |
| 10:00-10:30 AM | Chapt. 12 (TBD)                         |
| 10:30-11:00 AM | Chap 15 (Nusinovich for Granatstein)    |
| 11:00-12:00 PM | Overview, timetable, proposal & wrap-up |

Presentations for overflow topics (web site, proposal, etc)

Room available until 6:00 PM

Attendees:

Dr. Robert J. Barker  
AFOSR (NE)

Prof. John H. Booske  
University of Wisconsin

Dr. George Caryotakis  
Stanford Linear Accelerator Center

Prof. K.R. Chu  
National Tsing Hua University, Taiwan

Prof. Ronald M. Gilgenbach  
University of Michigan

Prof. Victor L. Granatstein  
University of Maryland

Dr. Patrick Helles  
AFRL/VSSE

Dr. A. Lin  
UCLA

Dr. Larry D. Ludeking  
Mission Research Corporation

Prof. Neville C. Luhmann, Jr.  
University of California, Davis

Following is the Book Outline:

## **“Modern Microwave & MM-Wave Power Electronics”**

### **CONTENTS** **(as of 31 July 2003)**

**Foreword**

**Preface**

**Acknowledgements**

**List of Contributors**

**List of Acronyms and Abbreviations**

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### **Chapter 1. Introduction and Overview**

1.1 Setting and Motivation

1.2 Importance of Vacuum in Microwave power electronics



- Role of vacuum and solid state
- 1.3 Anatomy of a MVED device
- 1.4 Organization and Scope of this book

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    - 2.1.3 Forward Wave/ Backward Wave Devices
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